WINNICUT DAM REMOVAL FEASIBILITY STUDY
DAM INSPECTION REPORT

To: Mr. James Gallagher
Chief Water Resources Engineer
Water Division – Dam Bureau
Department of Environmental Services
6 Hazen Drive
P.O. Box 95
Concord, NH 03302-0095

Subject: Inspection of Winnicut Dam, NATDAM#: NH00040

From: Michael R. Chelminski, Water Resource Engineer (NH PE No. 10677)
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Classification: "A"

Date: September-October 2003

PERTINENT DATA:

Inspection Date(s):	September 5, and October 17, 2003
Town:	Greenland
Water Body:	Winnicut River
Height of Dam:	13.15 ft
Length of Dam	95 ft
Length of Spillway:	75 ft
Spillway Elevation	11.2 ft (NAVD88)
Freeboard:	2.9 ft
Pond Area (below Rt. 33):	0.8 acre
Pond Area (above Rt. 33):	33 acre
Drainage Area:	14.2 sq mi
Storage (below Rt. 33):	6.7 acre-ft
Storage (above Rt. 33):	130 acre-ft
Storage (total):	137 acre-ft
50 Year Storm:	780 cfs
Discharge Capacity:	600 cfs w/ 1.0 ft freeboard 2120 cfs max discharge, logs out of fish ladder and stoplog bay
Type of Construction:	Concrete gravity
Construction Date:	1957
Outlet Works:	76.5 ft (w) x 2.9 ft (h) spillway 4 ft (w) x 12.5 ft (h) stoplog bay Fish Ladder w/ 5 ft (w) bays

OWNER/OPERATOR:

New Hampshire Fish & Game Department
Mr. Chuck Miner
603-271-2224
cminer@wildlife.state.nh.us

HYDROLOGY/HYDRAULICS:

A hydrologic analysis was performed using regional regression equations developed by the United States Geological Survey and incorporated into the National Flood Frequency (NFF) computer software program. The results of this analysis are presented in Table 1, and are in general agreement with previous hydrologic analyses of the Winnicut Dam.

Table 1: Peak Flows

Return Interval (years)	Peak Flow (cfs)
50	780
100	960
500	1490

Under normal operating conditions with the top of stoplog 1 foot below the spillway crest, the calculated discharge capacity for the dam is 600 cubic-feet-per-second (cfs), which is below the calculated peak flow of 780 cubic-feet-per-second cfs for the 50-year event. The calculated freeboard for the 50-year event is 0.6 feet. With all of the stoplogs removed from the stoplog bay and the fishpass, the calculated discharge is 2130 cfs with water to the top of the dam (14.0 NAVD 88).

Because there are currently no mechanical means for clearing debris from the stoplog bay or fishpass, the calculated discharge for the case with all of the stoplogs removed should be considered an upper threshold of the potential discharge capacity.

Note that the impoundment created by the dam is presented for the respective portions on each side of the RT 33 Bridge. The bridge opening represents a significant constriction in the Winnicut River, and it has a visible effect on the hydraulics during periods of higher flow (i.e., greater than ~ 150 cfs). The backwater created by this opening during higher flows is, to a large extent, independent of the backwater created by the dam. In addition, peak flows resulting from failure of the dam would largely be a function of the impoundment between the dam and the bridge only.

CLASSIFICATION AND JUSTIFICATION: "A"

The dam is classified as a "Class A Structure" as its height of 13.15 feet and maximum storage of 137 acre-feet are in excess of the requirements for designation as a Class AA, Non-Menace Structure (i.e., 6 feet and 50 acre-feet, respectively). As specified in Env-Wr 101.04, a "Class A

Structure" is defined as a dam with a low hazard potential, the failure of which would result in any of the following:

a) No possible loss of life, as defined in Env-Wr 101.29;

b) Minimal economic loss;

c) Major damage to town and city roads; or

d) The release of liquid industrial, agricultural, or commercial wastes or municipal sewage if the storage capacity is less than 2 acre-feet and is located more than 300 feet away from a waterbody or water course.

Observations made during the dam safety inspection are consistent with these criteria and, therefore, the result of this dam safety inspection is concurrent with the previously assigned rating as a "Class A Structure." Specific factors considered in the assignment of this rating include the relatively small size of the impoundment between the dam and the bridge located approximately 300 feet upstream. The hydraulic constriction imposed at the bridge opening would restrict the volume and peak flow of water in the event of an instantaneous dam failure. This factor combined with lack of significant infrastructure in the downstream floodway would likely result in limited damage as a result of a dam failure.

EMERGENCY ACTION PLAN STEPS:

Not Applicable

OPERATIONS AND MAINTENANCE:

An operations and maintenance plan was not found for this dam. Based on discussions with NH F&G and USGS personnel, there has been ongoing work associated with improving the operation of the existing fishpass and modifying the stoplog bay to develop an accurate stage-discharge relation during periods of low flow.

INSPECTION RESULTS:

The following deficiencies were noted in the course of the dam safety inspection (All directions are referenced facing downstream [i.e., towards Great Bay]):

1) Thick brush was present adjacent to the downstream portion of the left abutment and fishpass, precluding a thorough inspection of the dam and fishpass structure in this area (Photo 1).

2) A horizontal crack is present on the right pier of the stoplog bay (left spillway training wall [Photo 2]).

3) This crack is noted in previous inspection reports.

4) There is a small area (less than 2 square feet) of surface spalling on the face of the right abutment [Photo 3]). The spalling is noted in previous inspection reports.

5) Undermining of the fishpass foundation was observed immediately downstream of the stoplog bay.

6) There is unrestricted access to the spillway from the right abutment.
7) There is no signage indicating the presence of the dam upstream of the RT 33 Bridge.
8) A formal operations and maintenance plan was not found for this dam.

RECOMMENDATIONS:

The following recommendations are made regarding deficiencies noted in the course of the dam safety inspection:

1) Remove brush within 10 feet of the dam and fishpass structure.
2) Monitor and repair the crack on the right pier of the stoplog bay (left spillway training wall).
3) Monitor and repair (as necessary) the spalling on the face of the right abutment.
4) The undermining of the fishpass foundation downstream of the stoplog bay should be addressed through the placement of suitable scour countermeasures in this area. Because of the potential for very high flow speeds in this area (i.e., > 20 feet-per-second), rock riprap may not provide a long-term countermeasure. It is therefore recommended that alternatives measures be evaluated, such as increasing the overall size of the concrete apron, installation of articulated concrete blocks downstream of the existing apron, or other suitable countermeasures.
5) Exclusionary devices (e.g., fencing) should be installed on or adjacent to the right abutment to prevent unauthorized access to the spillway.
6) Provide signage upstream of the RT 33 Bridge indicating the potential hazard associated with the downstream dam.
7) The owner should prepare a formal operations and maintenance plan for the dam. This plan should describe operational and maintenance procedures, and identify emergency contact personnel.

GENERAL COMMENTS:

The Winnicut Dam was built in 1957 at a site on the Winnicut River in Greenland, New Hampshire, that has been occupied by a number of dams since European settlement. The dam consists of a monolithic concrete gravity section with an overlying spillway and reinforced concrete abutments. A fishpass and stoplog bay are incorporated into the dam's construction, and are situated between the left abutment and the left spillway training wall. The stoplog bay is full-height and 4 feet wide. The previous dam at this site apparently washed out at least 10 years prior to the construction of the current dam.

Observations made in the course of the dam safety inspection indicate that the Winnicut Dam is in generally sound condition. The primary deficiencies observed during the dam safety inspection are related to public safety, based on the unhindered access to the spillway from the right abutment and the lack of warning signs indicating the presence of the dam to recreational boaters upstream of the RT 33 Bridge. During periods of high flow, there is a significant likelihood that recreational boaters passing under the RT 33 Bridge, immediately upstream of the

dam, could be swept over the spillway of the dam. The likelihood of this scenario occurring is increased by the presence of the YMCA's Camp Gundalow approximately ½-mile upstream of the dam.

In addition to deficiencies addressed in the "Inspection Results" section of this report, a review of historical information on the Winnicut Dam suggests that the Canadian Step Weir fishpass incorporated into the left abutment performs poorly with regard to upstream passage of migratory fish. While the performance of the fishpass has apparently improved as a result of modifications by NH F&G, observations made at the dam indicate that the fishpass may be deficient in handling a range of flow and headwater conditions.

Photo 1 Winnicut Dam from right abutment (note vegetation encroaching on the left abutment adjacent to the fishpass).

Photo 2 Crack in concrete on left spillway training wall.

Photo 3 Spalling concrete on the face of the right abutment.